Modelling the Trans-placental Transfer of Maternal Antibodies

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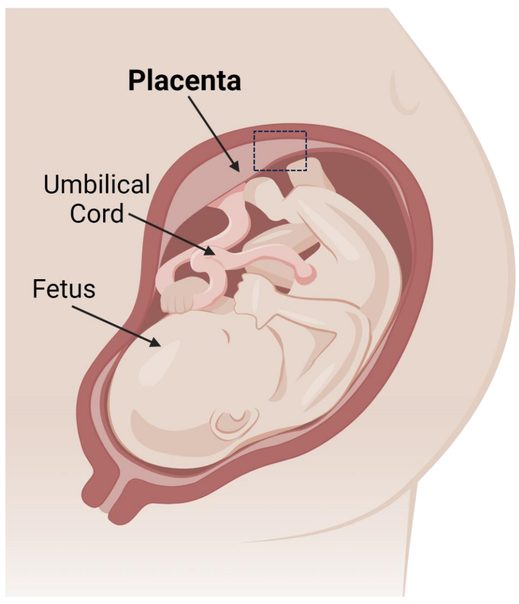
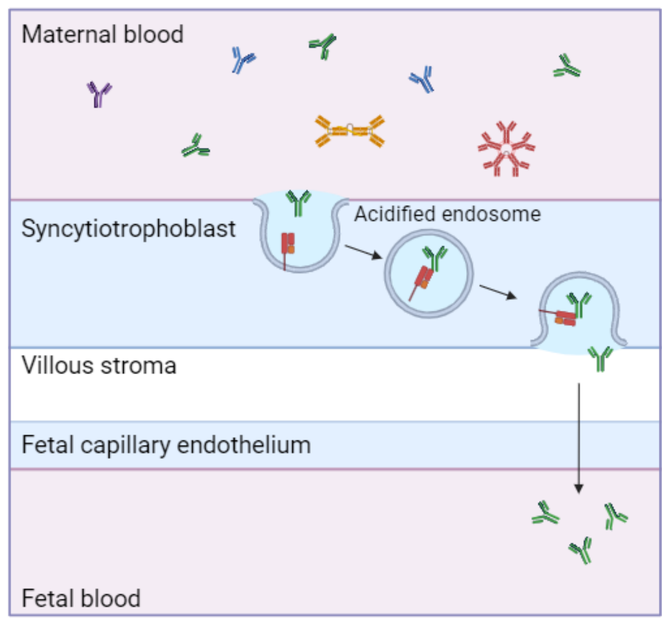
How does the placenta provide immune protection?



The transport and exchange of nutrients via the placenta is crucial for healthy fetal development

The active transfer of maternal antibodies from mother to fetus provides immune protection for the neonate in early life and is mediated by the neonatal Fc receptor, FcRn

Maternal antibodies (IgG) transfer across the placenta at different efficiencies depending on their characteristics, but we do not fully understand why

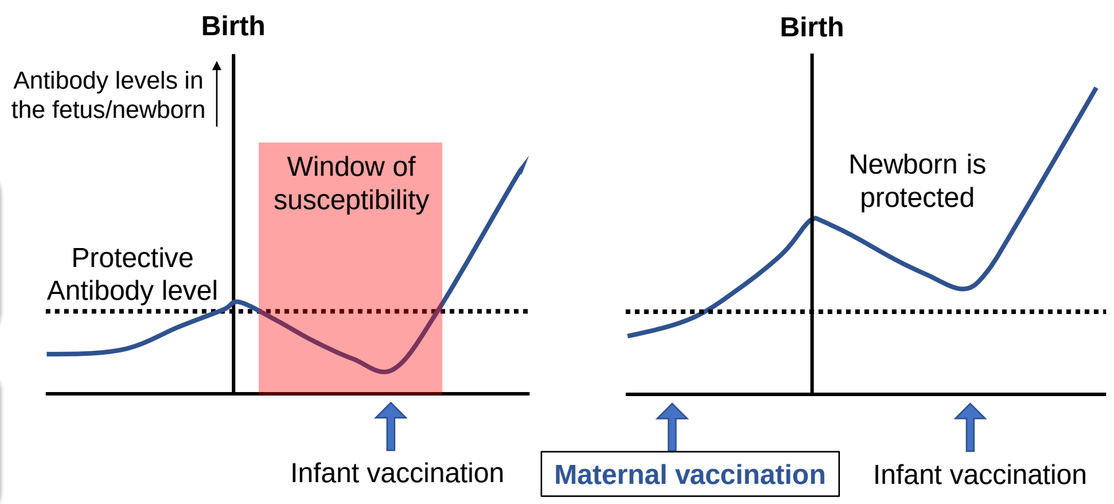


Why are maternal vaccinations important?

Transferred immunity to the fetus can be boosted by maternal vaccination strategies

Current maternal vaccines
COVID-19
Influenza
Pertussis

On the horizon
Group B Strep
RSV



Hypothesis:

There are specific molecular features that define the efficiency of placental antibody transport

Project Aim:

To develop and utilise *in vitro* models to study the determinants of natural and engineered antibody transfer across the human placenta

Design your own antibody transfer model

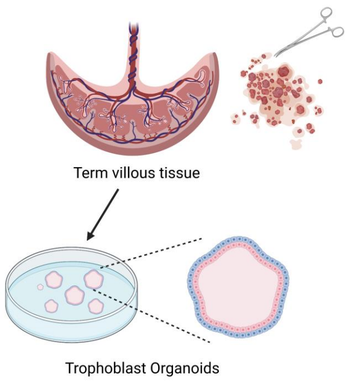
Current placental transfer models, including the perfusion model, are technically challenging and low throughput. Rodent animal models are not physiologically relevant to the human placenta, therefore, there is a need for *in vitro* models to assess the determinants of trans-placental antibody transfer.

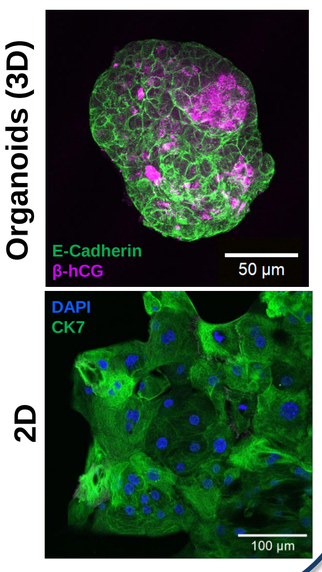
1. Choose the Cells

Cell line
- Less physiologically relevant
- Lack expression of FcRn
- Immortalised cell line

Primary Cells
- Isolated from the placenta
- Spontaneously syncytialise and polarise
- Terminally differentiated

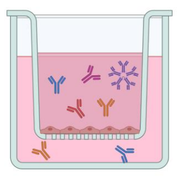
Trophoblast Stem Cells
- Primary cells
- Can be differentiated
- Long term passaging



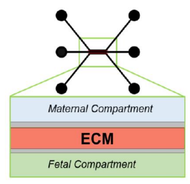


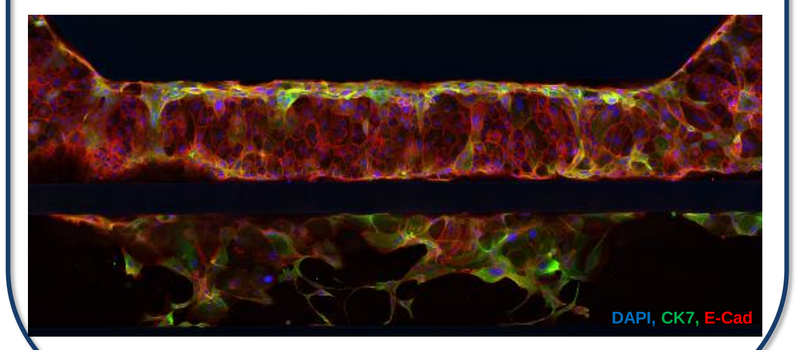
2. Choose the Model

Transwell
- 2D static model
- Previously used for IgG transfer
- Technically simple
- High throughput

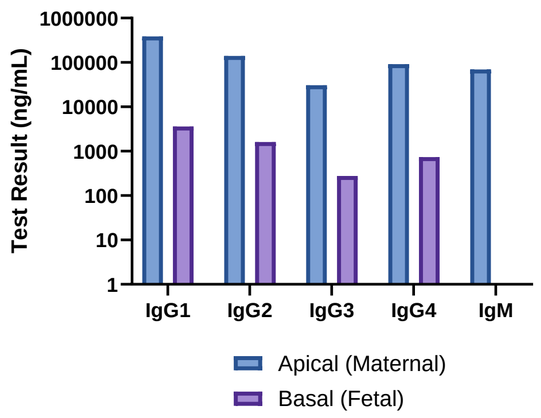


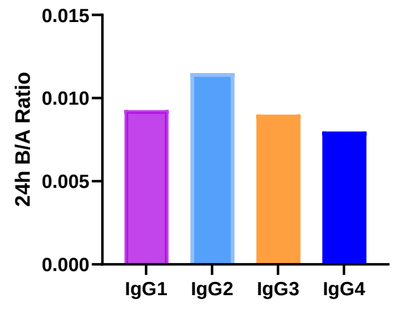
Placenta-on-a-chip
- 3D growth of cells
- Co-culture and compartmentalise different cell types
- Mimic interfaces
- Fluidic environment





3. Determine *in vitro* Antibody Transfer





Impact for pregnant women and their babies

Modelling the determinants of antibody transfer at the maternal-fetal interface is crucial to guide the optimal design of future vaccine and antibody therapeutics for pregnant women and their babies.

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